DESCRIPTION

DIE FOR DIE-CASTING

TECHNICAL FIELD

The present invention relates to a die for die-casting.

BACKGROUND ART

A die-casting method has conventionally been adopted as a method of producing a casting from aluminum or the like. In this method, a pair of dies are put together to form therebetween a cavity for forming a target casting product, and molten metal is injected into the cavity, the pair of dies being separated from each other after solidification of the molten metal to extract the casting as the target product.

However, the conventional die-casting method has a problem in that, after the injection of molten metal into the cavity, a gas, such as air, having existed in the cavity until then, remains in the molten metal, with the result that blowholes (pinholes) are generated in the resultant casting, which is undesirable for the product.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a die for die-casting capable of preventing development of blowholes in the

casting.

In order to attain the above-mentioned object, according to the present invention as claimed in Claim 1, there is provided a die for die-casting in which a molten metal is injected into a cavity formed by a die main body to thereby produce a casting, the die for die-casting characterized by including: a cooling means for cooling the die by feeding and discharging a fluid while maintaining the fluid under negative pressure; and a gas purging means establishing communication between the cavity and the cooling means and adapted to discharge a gas in the cavity into the cooling means.

According to the present invention as claimed in Claim 2, the die for die-casting as claimed in Claim 1 is characterized in that the cooling means is a cooling pipe inserted into the die main body, and that the gas purging means is a gas purging passage formed in the die main body so as to establish communication between the cavity and the cooling means.

According to the present invention as claimed in Claim 3, the die for die-casting as claimed in Claim 2 is characterized by further including a holder arranged in the periphery of the die main body and a pushing pin inserted into the die main body and capable of being plunged into and retracted from the cavity, and the die for die-casting is characterized in that the gas purging passage includes a clearance between the pushing pin and the die main body, a clearance between the die main body and the holder, and a clearance between the cooling pipe and the die main body.

In the die for die-casting as claimed in Claim 1, any gas that would cause development of blowholes in the casting is sucked/discharged from the cavity into the cooling means by the

gas purging means.

In the die for die-casting as claimed in Claim 2, any gas that would remain in the casting to generate blowholes is sucked out by utilizing an existing cooling means for cooling the die.

In the die for die-casting as claimed in Claim 3, any gas in the cavity is discharged to the exterior of the cavity through the clearance between the pushing pin and the die main body, the clearance between the die main body and the holder, and the clearance between the cooling pipe and the die main body.

BRIEF DESCRIPTION OF THE DRAWING

Fig. 1 is a sectional view of a die for die-casting according to an embodiment of the present invention, showing a portion thereof in the vicinity of the cavity.

BEST MODE FOR CARRYING OUT THE INVENTION

An embodiment of the present invention will now be described with reference to the accompanying drawing.

A die for die-casting 1 according to this embodiment is equipped with a first die main body 3, a second die main body 5, a holder 7, a cooling means 9, and a pushing pin 11. Formed between the first die main body 3 and the second die main body 5 is a cavity 13 in conformity with the configuration of the target product. The cooling means 9 is equipped with a cooling pipe 15 and a base portion 17 arranged at the base thereof. The cooling pipe 15 is of a double structure. That is, it has a supply passage 19 which is arranged

at its axial center and adapted to feed cooling liquid to a portion near the cavity 13 and an annular return passage 21 which is arranged coaxially around the supply passage 19 and through which the cooling liquid returns to the base portion 17. The cooling pipe 15 extends through the second die main body 5 and the holder 7 arranged on the outer side thereof. The base portion 17 is arranged on the outer side of the holder 7, and is equipped with a cooling liquid feeding port 23 for feeding cooling liquid from a cooling liquid supply source (not shown) to the supply passage 19 and a cooling liquid discharge port 25 for recovering the cooling liquid from the return passage 21 to the cooling liquid supply source. Being sucked out from the cooling liquid discharge port 25, the cooling liquid circulates through the cooling pipe 15 while being maintained under negative pressure. The pushing pin 11 extends through the second die main body 5 and the holder 7 so as to be capable of reciprocating in the longitudinal direction thereof. One end of the pushing pin 11 is connected to a drive source (not shown), and the other end thereof can reach the position where the cavity 13 exists. At an interface 27a between the pushing pin 11 and the second die main body 5, an interface 27b between the second die main body 5 and the holder 7, an interface 27c between the cooling pipe 15 and the second die main body 5, there are secured clearances through which at least gas can pass. In this embodiment, those clearances function as a gas purging passage 27.

Next, the operation of this die for die-casting, constructed as described above, will be illustrated. When the first die main body 3 and the second die main body 5 are put together, the cavity 13 for forming the target casting product is formed therebetween.

Then, molten metal 29 is poured into the cavity 13 through a gate (not shown). At the same time, cooling liquid is circulated under negative pressure through the cooling pipe 15. If, at this time, a gas, such as air, that would cause development of blowholes remains in the cavity 13, such gas is sucked out/discharged into the return passage 21 of the cooling pipe 15 through the gas purging passage 27 as the cooling liquid is circulated under negative pressure. Thus, the molten metal 29 in the cavity 13 is solidified in a state in which any gas that would cause development of blowholes has been appropriately removed therefrom. In this way, development of blowholes in the casting is prevented. Once the molten metal has been solidified, the pair of die main bodies 3 and 5 are separated from each other, and the casting as the product is taken out from the cavity 13. At this time, the end portion of the pushing pin 11 is caused to protrude beyond the mating surface PL of the second die main body 5 so that the casting may be appropriately separated from the second die main body 5. That is, in this embodiment, in addition to its inherent function to facilitate separation of the casting from the die main body, the pushing pin 11 also serves to form a part of a clearance constituting the gas purging passage 27.

In inserting the cooling pipe into the die, it would be generally necessary for a cooling liquid sealing means to be provided between them. In this embodiment, however, the clearance between the second die main body 5 and the cooling pipe 15 is positively utilized, so that it is possible to omit such a sealing means. Further, in the case in which the circulation of the cooling liquid is effected by pumping the cooling liquid into the cooling pipe, the cooling

liquid may leak through the gap between the second die main body 5 and the cooling pipe 15 if no sealing means were provided. In this embodiment, however, the cooling liquid is sucked out of the cooling pipe, so that, even if such a sealing means is omitted as described above, it is possible to avoid leakage of cooling liquid.

Further, even if a crack 31 should be generated in the portion of the second die main body 5 in the vicinity of the end of the cooling pipe 15, in this embodiment, the cooling liquid in the cooling pipe 15 will not flow into the cavity 13 through this crack 31 since the cooling liquid is circulating under negative pressure. Conversely, any gas in the cavity 13 is discharged from the crack 31 into the cooling pipe 15. That is, it is also possible to utilize the crack 31 as a gas purging means for preventing development of blowholes.

It is to be noted that the die for die-casting of the present invention is not restricted to the type which is equipped with a pushing pin and which uses, as a gas purging means, the gas purging passage formed by the clearance between the pushing pin and the second die main body, the clearance between the second die main body and the holder, and the clearance between the cooling pipe and the second die main body. Thus, it is also possible, for example, to use, as the air purging means, a dedicated air purging passage establishing direct communication between the cavity and the cooling pipe.

As described above, in the die for die-casting of the present invention, it is possible to prevent development of blowholes in the casting by discharging the gas in the cavity into the cooling means.

Further, in the case in which the gas purging passage is formed by the clearance between the pushing pin and the die main body, the clearance between the die main body and the holder, and the clearance between the cooling pipe and the die main body, it is possible to utilize the pushing pin not only in facilitating separation of the casting but also in preventing development of blowholes in the casting.